PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/JP2004/009239	23.06.2004	23.06.2003

International Patent Classification (IPC) or both national classification and IPC
G01N21/55

Applicant
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1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/JP2004/009239

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ in written format

   ☐ in computer readable form

   c. time of filing/furnishing:

   ☐ contained in the international application as filed.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. II Priority

1. ☒ The following document has not been furnished:

   ☒ copy of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(a)).

   ☐ translation of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(b)).

   Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. ☐ It has not been possible to consider the validity of the priority claim because a copy of the priority document was not available to the ISA at the time that the search was conducted (Rule 17.1). This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

4. Additional observations, if necessary:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	7,21-22
	No:	Claims	1-4, 6-20
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-22
Industrial applicability (IA)	Yes:	Claims	1-22
	No:	Claims	

2. Citations and explanations

see separate sheet

RE: SECTION V

1. The present application relates to a chemical sensor and apparatus comprising such a sensor which operates in a surface plasmon sensing mode and wherein the sensor medium comprises a periodic structure.

   The following documents are referred to:

   D1=JP2002357543; D2=US2002021445;
   D3="Design and fabrication of array format SPR chips in microstructure monolayers detection"; Chang S et al; 2nd Annual International IEEE-EMBS Special Topic Conference on Microtechnologies in Medicine and Biology, pages 386-389; 2-4 May 2002;
   D4=US2001031503; D5=US5442448;
   D10="Highly selective protein patterning on gold-silicon substrates for biosensor applications"; Langmuir, Vol. 18, Nr. 17, pages 6671-6678; Aug 20 2002; Veiseh Mandana.

2. CLARITY AND INTERPRETATION OF CLAIMS

   - "length of circumference which is substantially an integral multiple of a wavelength of the surface plasmon polariton wave". This expression should be clarified by detailing that the circumference which is referred to is that of the metal portion between openings with reference to its cross-section in a direction perpendicular to the substrate surface. In addition it should be noted that this wording is sufficiently broad to include any arrangement permitting a plasmon resonance to occur across a plurality of openings (i.e. constructive interference providing resonance at an integral mulitple of wavelength) when light with an appropriate wave vector is incident on the structure.

3. PRIOR ART

D1 (Figs. 8-13) discloses a surface plasmon resonance sensor chip for analysing samples in biochemistry, which according to embodiment shown in Figs. 8-10 comprises a sensor chip 31 which has a diffraction grating 35 that is formed by etching, machining, or stamping a metal film deposited on a substrate 32 so as to form openings through the metal film to the surface of the substrate. Biochemical binding agents such as antibodies 36, 37 are immobilised on the surface of the metal film or on the substrate to provide a sensing arrangement for binding partners in a solution to be analysed using either a reflection or transmission geometry.

D2 (Fig. 2C) discloses fabrication of surface plasmon polariton structures in two dimensional format in which a 2D pattern of scattering centres is written in a metal coated glass substrate, e.g. by using electron beam lithography or laser ablation to generate a pattern of holes 26 (or indentations 28) written in a metal layer 12. The device is intended for use in ultra sensitive applications such as single molecule (fluorescence) detectors or in biological/medical systems. The structure is preferably fabricated by semiconductor/silicon processing. In view of the two dimensional arrangement of openings this document discloses an arrangement of a selected central opening surrounded by a circular arrangement of "recesses" i.e. further openings equidistant from the selected central opening.

D4 (Fig. 3) discloses an SPR diffraction grating sensor comprising a series of grooves on a surface 305 whose period may range from less than 0.4 micrometers to over 2.0 micrometers, a metal layer 310, a substrate 300 and a sensitizing layer 330 such as antigens for binding antibodies.

D5 (Fig. 3) discloses a surface plasmon sensor for determining interactions between antigens-antibodies comprise a substrate 18 provided with a grating structure 24 of period length L=0.5 micron in which plasmons are excited in the metal layer 22.

4. NOVELTY

In view of the comments with respect to interpretation of claims and the disclosure of prior art above:

Claims 1-3, 4-6, 8-9, 11-18. See D1;

Claims 1-4, 8-10, 12-17, 19-20. See D2;

Claims 1-2, 14, 16-18. See D4;

Claims 1-2, 14, 16-17. See D5;

- together claims 1-4, 6-20 do not meet the requirement of novelty (Art. 33.2 PCT).

5. INVENTIVE STEP

Claim 7. Plurality of structure having different pitches of direction of periodicity. See D3 (Fig. 3) - chip format.

Claims 21-22. Sensor medium integrally supported in DNA chip or protein chip through semiconductor process. D1 and D3 refer to "chip" and D10 discloses protein patterning on metals on silicon substrates - in addition the miniaturisation of SPR devices is a standard motivation for skilled persons in this field.